ELECTRICAL CONTACTING OF THIN ENAMELED WIRES OF SECONDARY WINDINGS OF IGNITION COILS

The present invention relates to an electrical connection set-up for manufacturing an ignition coil, particularly a rod-type ignition coil having an ignition coil rod with a high-voltage outlet.

Background Information

Ignition coils produce high-voltage sparks. This spark jumps between the electrodes of the spark plug set up at the ignition coil, thus igniting the air-gasoline mixture of an internal combustion engine, for example. Normally, this spark plug is supplied with high voltage from an ignition coil. A primary winding and a corresponding secondary winding are provided within the ignition coil. At one end, the primary winding is connected to an ignition switch, while its other end is connected to a so-called contact breaker.

The secondary winding, that is, the winding responsible for generating the ignition spark, is connected in the interior of the ignition coil to the one end of the primary winding, so that it is grounded. The other end of the secondary winding is connected to the high-voltage outlet, which in turn is either connected to an ignition cable leading to the spark plug, or at which the spark plug is set up directly.

The secondary winding itself is made of a thin wire coated with a suitable layer of enamel so as to avoid the contacting of the individual wires when wrapping a specific support part or coil shell. After the secondary windings have been wound onto a shell, the ends of the respective wires are contacted.

Normally, thermal contacting methods such as soldering or welding, for example, are known for this purpose.

Disadvantages of the Related Art

Different work processes are required especially with regard to contacting the primary and secondary windings. This entails higher installation costs, multiple assembly steps and also a certain number of connecting parts necessary to make an appropriate electrical connection.

Furthermore, in such a tight installation space, it was often difficult to bring about an appropriate contacting using the known thermal methods.

Object of the Invention

The object of the present invention is to provide a connection set-up between an ignition coil rod of an ignition coil and a secondary or primary winding which is inexpensive and readily implemented.

Achievement of the Objective

The basic principle for achieving the objective is to replace the thermal contacting method known per se from the related art. This is achieved by providing additional contacting elements that break through the insulation of the enamel-coated wire of the secondary winding during installation, thus bringing about an appropriate contacting.

Summary of the Invention

In particular, it may be seen as an advantage for the electrical connection set-up for producing an ignition coil, that the contacting according to the present invention is integrated into already existing components, and may be reliably produced using simple processes.

Compared to the previous method, the "cold" contacting method proposed here has the advantage that it involves no additional installation costs. In addition, the set-up of the present invention makes it possible to reduce the number of assembly steps and the number of connecting parts.

A further substantial advantage of the present invention is that the implementation of the contacting does not require optimization of the installation space. This means that it is not necessary to reserve a free space in the area of contacting, e.g. for electrode holders, soldering irons or the like.

Simply by sliding a contact sleeve onto the coil shell configured as a secondary winding, this contacting body may be slid directly onto the coil shell without shifting the installed secondary winding. This is achieved by the fact that the contact sleeve is slit lengthwise and may thus be opened up as a spring.

This contact sleeve features contact clips on its outer surface, which, after the contact sleeve has been slid onto the coil shell, contact the wire of the secondary winding due to their spring-like form in that the contact clip of the contact sleeve breaks through the insulation, for example an enamel coating of the wires of the secondary winding.

The contact sleeve is to be guided over the coil shell until it strikes against a stop formed on an ignition coil rod. To prevent damaging or shifting the secondary wire, the diameter of the contact sleeve is larger or at least equal to the diameter of the secondary shell and twice as large as the diameter of the wire. As soon as the contact sleeve is positioned in a very straightforward manner in the contacting area of the ignition coil rod, it is installed in the ignition coil housing with the high-voltage outlet. By insertion into a cup-shaped formation, the contact clips are pressed onto the winding of the secondary winding, thus breaking through the insulating layer of the wire and establishing a permanent electrical contact. The free end of the winding of the secondary wire is preferably wound around a pin-like formation at the end of the ignition coil rod. This pin is then inserted into the high-voltage outlet. This prevents failures of the ignition coil due to superelevations of the field at the end of the wire.

A space-saving alternative provides for rupture joints on the pin-like formation of the ignition coil rod. This has the effect that, when the assembly is installed into the ignition coil housing, the pin on the side of the high-voltage outlet breaks, and specifically inwardly in such a way that contact is ensured in spite of the break.

Further advantageous embodiments will become apparent from the following description as well as the drawings and the claims.

Brief Description of the Drawing

The figures show:

Fig. 1 A perspective view of an ignition coil having one side for the high-voltage outlet and another side for the low-voltage outlet;

Fig. 2 A sectional view through the ignition coil according to Fig. 1;

Fig. 3 An enlarged representation of the perspective view of the side of the high-voltage outlet of the ignition coil rod;

Fig. 4 A section through the enlarged view of the side of the high-voltage outlet according to Fig. 3;

Fig. 5 A perspective view of the contact sleeve for installation on the side of the high-voltage outlet;

Fig. 6 A sectional view of the contact sleeve according to Fig. 5;

Fig. 7 An enlarged partial representation of the contact clips of the contact sleeve according to the present invention according to Fig. 6.

Description of an Exemplary Embodiment

Fig. 1 shows a perspective view of an ignition coil 1. Ignition coil 1 includes an ignition coil housing 2 and an ignition coil rod 3 located in ignition coil housing 2. In addition, ignition coil 1 features a side for a high-voltage outlet H and a side for the low-voltage outlet N. The side of low-voltage outlet N is provided to establish contact with a power supply not detailed in the drawing, while the side of

high-voltage outlet H is provided for connecting to an ignition cable or a spark plug not detailed in the drawing.

Fig. 2 shows a sectional view of ignition coil 1 represented in Fig. 1, the areas shown relating to essential features of the invention represented in more detail in the subsequent figures.

On high-voltage side H, a contacting area 20 (Fig. 3) is provided on ignition coil rod 3, which provides for the installation of a secondary winding 22 on a coil shell 21. Following the completion of the winding of secondary wire 22, it is guided through a bore hole 23 into contacting area 20, where it is further wound until it enters a groove 24 and reaches a pin 25. At pin 25, the free end of secondary wire 22 is tied up.

A contact sleeve 26 depicted in Fig. 4 through 7 is now put over contacting area 20. This contact sleeve 26 has at least one axial slit 27, which preferably does not extend over the entire length. In addition, provided on the peripheral surface of contact sleeve 26 is at least one contact clip 28 for establishing a contact with secondary winding 22 in contacting area 20 on the side of high-voltage outlet H.

By virtue of axial slit 27, contact sleeve 26 is now guided over contacting area 20 of ignition coil rod 3 on the side of high-voltage outlet H until it reaches a stop 29. The expansion of contact sleeve 26 while sliding it on prevents secondary winding 22 on the side of high-voltage outlet H from being damaged in any way. Contact sleeve 26 is designed in such a way that it reaches a press fit immediately after it

has been slid over the contacting area, preventing contact sleeve 26 from falling off again.

As shown in Fig. 4, this assembly made up of ignition coil rod 3 and contact sleeve 26 is now installed into high-voltage outlet H of ignition coil housing 2. Ignition coil housing 2 features a cup-shaped formation 30 for receiving the free end of ignition coil rod 3. In addition, a recess 31 is provided for receiving pin 25 of ignition coil rod 3.

Due to cup-shaped formation 30 of ignition coil housing 2, contact clips 28 of contact sleeve 26 are pressed in a defined manner in the direction of an arrow 32 (Fig. 4). The insulating layer of secondary wire 22 is thereby pierced and an electrical contact permanently established. The free end of secondary wire 22, which is wound around pin 25, is inserted into recess 31. At the same time, stop 29, located on the side of ignition coil rod 3, rests on a shoulder 33 on the side of ignition coil housing 2. By integrating the contacting option and existing components, it has become possible to create contacting options between components and the secondary winding in an ignition coil via simple joining operations, while saving additional installation costs, assembly steps and the like.